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cate affinities, with so many different groups, that he has been obliged to place them in a separate order by themselves. "*Sycometra compressa appears as a sponge stock which bears upon one and the same cormus the mature forms even of eight different genera.*"

In conclusion Professor Hæckel begs all of his readers who may be in possession of specimens of calcareous sponges to send them to him for examination and comparison.

THE EXTINCT MAMMALIAN FAUNA OF DAKOTA AND NEBRASKA.* — This important work is the final expression, the author informs us, of labors extending over a period of twenty-three years, during which the materials on which it is based, have been accumulating. Sufficient time has elapsed to allow of corrections of first identifications, and we have the result in a memoir of much completeness and accuracy in the topographical descriptions of the remains preserved in such unusual perfection and abundance in the localities in question. Fortunately the Academy of Natural Sciences of Philadelphia numbers among its members liberal minded men of wealth, for without the "sinews" of the undertaking furnished by Messrs. Joseph Jeanes and William P. Willstach, this work would not have seen the light. As it is, the execution both in printing and lithography, is a credit to all concerned.

The species hitherto discovered in the Bad Lands belong to two series of strata, determined many years ago by Dr. F. V. Hayden to be Miocene and Pliocene respectively. Fossils from these, and a few of Postpliocene age are included. derived from the area in question. The whole number described is eighty-six, distributed as follows: Carnivora, fifteen; Artiodactyla, thirty-four; Perissodactyla, twenty-nine: Rodentia, six; Insectivora, two. With reference to the relations of the genera and species, we let the author speak, by quoting his valuable summary at the close of the descriptive portion of the work:

> "In comparing the two lists representing the North American tertiary mammals, mainly from the states of Dakota and Nebraska, with the third list representing the quaternary mammals of the same continent, a remarkable dissimilarity is observed, and there is also noticed a greater resemblance of the former with the tertiary and quaternary mammals of the old world.
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> Of thirty-two genera of miocene terrestrial mammals, chiefly from the Mauvaises Terres of Dakota, not one occurs in the quaternary formation of North America; and of twenty-one genera of pliocene terrestrial mammals, chiefly from the Niobrara River of Nebraska, only eight are common to the quaternary formations of North America, and of these eight three are absent in the existing fauna of the continent. The eight genera alluded to as common to the pliocene tertiary and the quaternary formations are Canis, Cervus, Dicotyles, Mastodon, Elephas, Equus, Hipparion and Castor.
>
> It is uncertain how far the species of Canis attributed to the Niobrara pliocene formation are peculiar to it. Part of the fossils may be quaternary, or perhaps, even recent remains. Of Cervus, part of the specimens referred to it may be of a recent species, while the antler viewed as pertaining to the same may represent a peculiar genus, subsequently extinguished. The only remains indicative of Dicotyles was an upper canine tooth which may really have belonged to a quaternary or perhaps a recent species. The remains of the pliocene mastodon

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* The Extinct Mammalian Fauna of Dakota and Nebraska, with a Synopsis of the Mammalian Remains of North America. By Joseph Leidy, M. D., LL. D., preceded by an Introduction on the Geology of the Tertiaries of Dakota and Nebraska, by Professor F. V. Hayden, M. D.

pertain to the subgenus Tetralophodon, while those of the quaternary period belong to the subgenus Trilophodon.

The remains of Elephas probably indicate a species distinct from the quaternary *E. americanus*, though it is not positively ascertained. The remains of Equus appear to be different from those of the later *E. fraternus*. The genus Hipparion is clearly common to both the pliocene and quaternary period, but the species are different. Protohippus, one of the solipedal genera of the Niobrara pliocene, appears also to have existed during the quaternary period, in Chili, South America. A small species of Castor, of the Niobrara pliocene, is represented by the larger quaternary and still existing Beaver.

The quaternary fauna of both American continents was especially distinguished by the presence of those wonderful creatures, the giant sloths, no trace of which has been detected in the tertiary formations of North America. This appears the more remarkable from the circumstance that remains of several edentate genera have been discovered in the miocene formations of Europe.

The presence in the quaternary fauna of North America of the great sloths, together with other ordinal and generic forms, which likewise existed, and in part still continue to exist, in South America, leads to the impression that the North American continent during the quaternary period was peopled by the extension of life from the south. The greater similitude of the miocene and pliocene faunæ which we have investigated in the present work, with the contemporaneous faunæ of the old world, suggests the probability that the North American continent was peopled during the tertiary period from the west. Perhaps this latter extension occurred from a continent whose area now forms the bottom of the great Pacific Ocean, and whose tertiary fauna is now represented east and west by the fossil remains of America on the one hand, and of Asia with its peninsula, Europe, on the other.

In comparing the miocene and pliocene faunæ with each other, as represented mainly by the remains from the Mauvaises Terres and the Niobrara River, we observe the remarkable fact that in upwards of fifty genera belonging to the two faunæ together, scarcely a genus is common to both. In view of the consecutive order and close approximation in position of the two formations and faunæ, such an exclusiveness would hardly have been suspected.

Thus, for instance, the pliocene Merychyus may be regarded as identical generically, with the miocene Oreodon; but after all these are the only ones which could be looked upon as the same, unless perhaps Rhinoceros is included. In this case, however, the miocene *Rhinoceros occidentalis* appears to have been an Aceratherium, while that of the pliocene formation was probably a true or horned Rhinoceros.

Of all other known faunæ, extinct and recent, those of Dakota and Nebraska, under consideration, appear to approximate most in their relationship with the tertiary faunæ of Europe.

Of the carnivora of the former localities, comprising eight genera and fifteen species, five of the genera, or more than one-half, are found in the European tertiaries, as for instance: Canis, Amphicyon, Hyænodon, Pseudælurus, and Drepanodon. The feline Dinictis of the Dakota miocene has not elsewhere been discovered. The remaining two carnivorous genera are too imperfectly known for comparison.

It is truly wonderful that of the numerous Ruminantia, comprising fourteen genera and nearly double that number of species, none, excepting the genus Cervus, belongs to any other known fauna extinct or recent. Even in the case of the excepted genus, it is probable that part of the remains attributed to it may belong to a peculiar subgenus, while others may be of a recent species.

When we compare the family relationships of the North American tertiary and quaternary ruminants, we find remarkable differences. A peculiar family, the Oreodontidæ, is represented in both the miocene and pliocene; in the former by three genera and many species, in the latter by a single genus. This family has nowhere else been discovered, neither in the American quaternary nor the foreign tertiary equivalents.

Another family, the Agriochœridæ, nearly allied to the former, is peculiar to the miocene of the *Mauvaises Terres*.

The Camelidæ are represented in the North American miocene pliocene and quaternary deposits, but particularly in the miocene, and they are yet represented in the existing fauna of South America.

The Moschidæ are represented by the genus Leptomeryx in the Dakota miocene, but not in the later formations of North America.

The Cervidæ are represented in the pliocene and succeeding epochs in North America. The Antilopidæ are represented by a genus in the Niobrara pliocene. The Capridæ and Bovidæ are not represented in North America prior to the quaternary period.

Of Artiodactyla exclusive of the Ruminantia, the remains of seven species of six genera belong to the Dakota miocene, of which two genera, Elotherium and Hyopotamus are common to the European tertiary. The remaining genera in part but imperfectly known, appear to be peculiar. The Niobrara pliocene presents us with traces of a peccary, but this probably may belong to a later period.

One of the artiodactyle genera of the Dakota miocene, the huge Titanotherium, was represented by the nearly allied Chalicotherium of the European and Himmalaya miocene period.

Of uneven-toed Pachyderms or Perissodactyla, the Dakota miocene presents one Acerathcrium, a peculiar genus of the same family, the Hyracodon, and a species of Lophiodon. The former and latter are both European tertiary forms. Another member of the Rhinoceros family, *R. hesperius*, from California, was probably an Aceratherium of miocene age. *R. meridianus* of Texas was probably of the same category as the latter.

The Niobrara pliocene presents us with three genera, Rhinoceros, Mastodon and Elephant. The former has not been found in the American quaternary, though abundant in its European equivalent, and continuing to exist in Asia and Africa. The Mastodon belonged to the subgenus Tetralophodon, while that of the quaternary period was a Trilophodon. Elephants of other species were nearly cosmopolite during the quaternary period; but two species now live in Asia and Africa.

Five genera of Solipeds appear to have lived in North America during the miocene period. Three of them are peculiar, and appear not to have been discovered elsewhere. They have been named Anchippus from Texas, Hypohippus from the Niobrara River, and Anchippodus from New Jersey. The remaining genus Anchitherium, characterized by an abundance of remains from the Mauvaises Terres belongs also to the European miocene.

The pliocene formation of the Niobrara is remarkable for the abundance of its equine remains, which have been referred to five genera, of which Merychippus and Parahippus are peculiar, and Protohippus has been discovered elsewhere only in South America. The remaining genera Hipparion and Equus belong also to the North American quaternary and likewise to the European quaternary and tertiary formations.

The miocene Rodents of the Mauvaises Terres belong to four peculiar genera of as many still existing families. One of the genera, Palæocastor, may be identical with the European chalicomys of Cotemporaneous age.

The pliocene Rodents of the Niobrara appear to belong to the still existing genera Castor and Hystrix, but the latter now exists only in the old world.

Of the few discovered quaternary rodents of North America, one genus, *Hydrochœrus*, now absent on this continent, still lives in South America.

The miocene Insectivora of North America belong to three genera not discovered elsewhere." pp. 359-362.

In reviewing the character of the work, the care and accuracy of the descriptions furnish a most valuable storehouse to the palæontological student of other strata or localities, and its conscientiousness in this respect constitutes its great merit. On the other hand, however, we fail to find in many cases, that exact comparison and clear diagnosis of genera proposed or adopted, by which the zoological affinity is alone expressed, and by means of which the analysis of the subject in the broad sense is so greatly facilitated. Without it, the student gropes in a mass of detail, and unless he fortunately have access to a good museum, will fail of acquiring a mastery of it. This refers also to a precise comparison with European genera, for which we have so many standards in figures and descriptions.

The synopsis of extinct mammalia is of equal or greater value to the student. The whole number of species enumerated is two hundred and three, of which Dr. Leidy has stood sponsor to one hundred and twenty. The species are distributed into the orders as follows: Carnivora, thirty-three; Artiodactyla, fifty-two; Perissodactyla, thirty-seven; Rodentia, twenty; Insectivora, five; Marsupialia, one; Edentata, seven; Sirenia, two; Zeuglodonta, two; Cetacea, forty-four. There are several species described for the first time, and the literary references are very complete. The system adopted by Dr. Leidy requires some comment. He adopts the order Bimana, a step which we regard as retrograde, since modern investigations, fresh in the mind of every student, have proved beyond cavil that that group is subordinate to the order Quadrumana. The division of Artiodactyla into Ruminantia and Artiodactyla as orders, ranking with other groups so-called, on the presence or absence of the functional peculiarity of rumination, is also contrary to the philosophy of a homological system. The separation of the Pinnipedia from the Carnivora has in the same manner little better foundation. The adoption of the Zeuglodonta as an order is perhaps a step forward, though in that case the Squalodons, which embrace ten of the twelve species included, must certainly be referred to the Cetacea. The separation of the Sirenia as an order has met with favor from Owen and others, and is well adopted in the present work.

THE EARLIEST EVIDENCES OF PLANT-LIFE.* — In this pamphlet Professor Dawson reviews the different substances which have been supposed to show that plants existed contemporaneously with the Eozöon in the Laurentian of Canada.

> "We may sum up these facts and considerations in the following statements: — First, that somewhat obscure traces of organic structure can be detected in the Laurentian graphite; secondly, that the general arrangement and microscopic structure of the substance corresponds with that of the carbonaceous and bituminous matters in marine formations of more modern date; thirdly, that if the Laurentian graphite had been derived from vegetable matter, it has only undergone a metamorphosis similar in kind to that which organic matter in metamorphosed sediment of later age has experienced; fourthly that the association of the graphitic matter with organic limestone, beds of iron ore, and metallic sulphides greatly strengthens the probability of its vegetable origin; fifthly, that when we consider the immense thickness and extent of the Eozoonal and graphitic limestones and iron-ore deposits of the Laurentian, if we admit the organic origin of the limestone of graphite, we must be prepared to believe that the life of that early period, though it may have existed under low forms, was most copiously developed, and that it equalled, perhaps surpassed, in its results, in the way of geological accumulation that of any subsequent period."

FOSSIL BIRDS.† — In this little pamphlet Professor Marsh imposes a new obligation on the science of Paleontology, by the discovery of five species of Cretaceous birds. Among the species there is one, *Paleotringa vetus*, described from the original specimen found by Dr. Morton. This is the first fossil bird bone found in this country, and though referred to by Dr. Morton in his Organic Remains of the Cretaceous period, has been hitherto considered a recent specimen, which by some accident had been buried in the Cretaceous marl deposits. The forms embrace one large swimming bird (*Laornis Edwardsianus*), two gulls (*Palæotringa littoralis*

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* On the Graphite of the Laurentian of Canada. By J. W. Dawson, LL. D., etc. Proceedings of the Geological Society, Postponed Papers, Vol. xxvi, Part 1. Pamphlet, pp. 5.

† Notice of the Fossil Birds from the Cretaceous and Tertiary Formations of the United States. By Professor O. C. Marsh. From American Journal of Science and Arts. March, 1870. Pamphlet, pp. 16.